

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

Cancel claims 16 and 17.  
Add new claims 22-47.

**Listing of Claims:**

1           **1. (Previously amended)** A method of voice activity detection  
2 comprising:  
3           determining a difference between (a) an average ratio of energy  
4 above a first threshold frequency in a signal comprising multiple  
5 frequencies and energy below the first threshold frequency in the signal  
6 and (b) a present ratio of energy above the first threshold frequency in the  
7 signal and energy below the first threshold frequency in the signal; and  
8           in response to the difference being exceeded by a first threshold  
9 value, indicating that the signal includes a voice signal; and  
10           in response to the difference exceeding a second threshold value  
11 greater than the first threshold value, indicating that the signal includes a  
12 voice signal.

1           **2. (Original)** The method of claim 1 wherein:  
2 the first threshold frequency is about 2400 Hz.

1           **3. (Original)** The method of claim 1 further comprising:  
2 prior to the determining, removing noise energy from the signal.

1           **4. (Original)** The method of claim 3 wherein:  
2 removing comprises  
3 filtering out from the signal frequencies below a second threshold  
4 frequency lower than the first threshold frequency.

1           **5. (Original)** The method of claim 4 wherein:  
2           the second threshold frequency is about 100 Hz.

1           **6. (Original)** The method of claim 1 further comprising:  
2           repeating the steps for successive segments of the signal.

1           **7. (Original)** The method of claim 1 further comprising:  
2           determining an average periodicity of the signal; and  
3           in response to the average periodicity of the signal being lower than  
4           a third threshold value, indicating that the signal includes a voice signal.

1           **8. (Original)** The method of claim 7 wherein:  
2           determining an average periodicity comprises  
3           estimating a pitch period of the signal;  
4           determining a gain value of the signal over the pitch period as a  
5           function of the estimated pitch period;  
6           determining a periodicity of the signal over the pitch period as a  
7           function of the estimated pitch period and the gain value; and  
8           averaging the determined periodicity with previously-determined at  
9           least one said determined periodicity.

1           **9. (Original)** The method of claim 7 further comprising:  
2           repeating the steps for successive segments of the signal.

1           **10. (Original)** The method of claim 7 further comprising:  
2           determining a difference between average total energy in the signal  
3           and present total energy in the signal; and  
4           in response to the difference between the average total energy and  
5           the present total energy being lower than a fourth threshold value and the  
6           average periodicity of the signal being lower than a fifth threshold value,  
7           indicating that the signal includes a voice signal.

1           **11. (Original)** The method of claim 10 further comprising:  
2           prior to determining the difference between the average total  
3 energy and the present total energy, removing noise energy from the  
4 signal.

1           **12. (Original)** The method of claim 1 wherein:  
2           determining a difference between the average total energy and the  
3 present total energy comprises  
4           determining a difference between average total energy in a  
5 voiceband of the signal and present total energy in the voiceband.

1           **13. (Original)** The method of claim 12 wherein:  
2           the voiceband extends from about 100 Hz to about 4000 Hz.

1           **14. (Original)** The method of claim 10 further comprising:  
2           repeating the steps for successive segments of the signal.

1           **15. (Original)** The method of claim 14 further comprising:  
2           in response to not indicating for a present segment of the signal  
3 that the signal includes a voice signal, and indicating for a segment of the  
4 signal preceding the present segment that the signal includes a voice  
5 signal, determining if the average total energy of the signal exceeds a  
6 minimum average total energy of the signal by a sixth threshold value; and  
7           in response to the average total energy exceeding the minimum  
8 average total energy by the sixth threshold value, indicating that the signal  
9 includes a voice signal.

1           **16. (Canceled)**

1           **17. (Canceled)**

1           **18. (Previously amended)** An apparatus for detecting voice  
2 activity comprising:  
3           means for determining an average ratio of energy above a first  
4 threshold frequency in a signal comprising multiple frequencies and  
5 energy below the first threshold frequency in the signal;  
6           means for determining a present ratio of energy above the first  
7 threshold frequency in the signal and energy below the first threshold  
8 frequency in the signal;  
9           means for determining a difference between the average ratio and  
10 the present ratio; and  
11           means cooperative with the means for determining a difference and  
12 responsive to the difference being exceeded by a first threshold value, for  
13 indicating that the signal includes a voice signal, and further responsive to  
14 the difference exceeding a second threshold value greater than the first  
15 threshold value, for indicating that the signal includes a voice signal.

1           **19. (Original)** The apparatus of claim 18 further comprising:  
2           means for determining an average periodicity of the signal; and  
3           means cooperative with the means for determining an average  
4 periodicity and responsive to the average periodicity being lower than a  
5 third threshold value, for indicating that the signal includes a voice signal.

1           **20. (Original)** The apparatus of claim 19 further comprising:  
2           means for determining a difference between average total energy in  
3 the signal and present total energy in the signal; and  
4           means cooperative with the means for determining a difference  
5 between the average total energy and the present total energy and the  
6 means for determining an average periodicity and responsive to the  
7 difference between the average total energy and the present total energy  
8 being lower than a fourth threshold value and the average periodicity of

9 the signal being lower than the fifth threshold value, for indicating that the  
10 signal includes a voice signal.

1           **21. (Original)** The apparatus of claim 20 for detecting voice activity  
2 in successive segments of the signal, further comprising:

3           means responsive to a lack of indication for a present segment of  
4 the signal that the signal includes a voice signal and to an indication for a  
5 segment of the signal preceding the present segment that the signal  
6 includes a voice signal, for determining if the average total energy of the  
7 signal exceeds a minimum average total energy of the signal by a sixth  
8 threshold value; and

9           means cooperative with the means for determining of the average  
10 total energy exceeds the minimum average total energy and responsive to  
11 the average total energy exceeding the minimum average total energy by  
12 the sixth threshold value, for indicating that the signal includes a voice  
13 signal.

1           **22. (New)** A computer-readable medium containing executable  
2 instructions which, when executed in a computer, cause the computer to  
3 perform the steps of:

4           determining a difference between (a) an average ratio of energy  
5 above a first threshold frequency in a signal comprising multiple  
6 frequencies and energy below the first threshold frequency in the signal  
7 and (b) a present ratio of energy above the first threshold frequency in the  
8 signal and energy below the first threshold frequency in the signal; and

9           in response to the difference being exceeded by a first threshold  
10 value, indicating that the signal includes a voice signal; and

11           in response to the difference exceeding a second threshold value  
12 greater than the first threshold value, indicating that the signal includes a  
13 voice signal.

1           **23. (New)** The medium of claim 22 wherein:  
2           the first threshold frequency is about 2400 Hz.

1           **24. (New)** The medium of claim 22 further comprising instructions  
2 for causing the computer to perform the step of:  
3           prior to the determining, removing noise energy from the signal.

1           **25. (New)** The medium of claim 24 wherein the instructions for  
2 removing comprise instructions for causing the computer to perform the  
3 step of:  
4           filtering out from the signal frequencies below a second threshold  
5 frequency lower than the first threshold frequency.

1           **26. (New)** The medium of claim 25 wherein:  
2           the second threshold frequency is about 100 Hz.

1           **27. (New)** The medium of claim 22 further comprising instructions  
2 for causing the computer to repeat the steps for successive segments of  
3 the signal.

1           **28. (New)** The medium of claim 22 further comprising instructions  
2 for causing the computer to perform the steps of:  
3           determining an average periodicity of the signal; and  
4           in response to the average periodicity of the signal being lower than  
5 a third threshold value, indicating that the signal includes a voice signal.

1           **29. (New)** The medium of claim 28 wherein the instructions for  
2 determining an average periodicity comprise instructions for causing the  
3 computer to perform the steps of:  
4           estimating a pitch period of the signal;  
5           determining a gain value of the signal over the pitch period as a

6 function of the estimated pitch period;  
7 determining a periodicity of the signal over the pitch period as a  
8 function of the estimated pitch period and the gain value; and  
9 averaging the determined periodicity with previously-determined at  
10 least one said determined periodicity.

1 **30. (New)** The medium of claim 29 further comprising instructions  
2 for causing the computer to repeat the steps for successive segments of  
3 the signal.

1 **31. (New)** The medium of claim 28 further comprising instructions  
2 for causing the computer to perform the steps of:  
3 determining a difference between average total energy in the signal  
4 and present total energy in the signal; and  
5 in response to the difference between the average total energy and  
6 the present total energy being lower than a fourth threshold value and the  
7 average periodicity of the signal being lower than a fifth threshold value,  
8 indicating that the signal includes a voice signal.

1 **32. (New)** The medium of claim 31 further comprising instructions  
2 for causing the computer to perform the step of:  
3 prior to determining the difference between the average total  
4 energy and the present total energy, removing noise energy from the  
5 signal.

1 **33. (New)** The medium of claim 22 wherein the instructions for  
2 determining a difference between the average total energy and the  
3 present total energy comprise instructions for causing the computer to  
4 perform the step of:  
5 determining a difference between average total energy in a  
6 voiceband of the signal and present total energy in the voiceband.

1           **34. (New)** The medium of claim 33 wherein:  
2           the voiceband extends from about 100 Hz to about 4000 Hz.

1           **35. (New)** The medium of claim 31 further comprising instructions  
2           for causing the computer to repeat the steps for successive segments of  
3           the signal.

1           **36. (New)** The medium of claim 35 further comprising instructions  
2           for causing the computer to perform the steps of:  
3           in response to not indicating for a present segment of the signal  
4           that the signal includes a voice signal, and indicating for a segment of the  
5           signal preceding the present segment that the signal includes a voice  
6           signal, determining if the average total energy of the signal exceeds a  
7           minimum average total energy of the signal by a sixth threshold value; and  
8           in response to the average total energy exceeding the minimum  
9           average total energy by the sixth threshold value, indicating that the signal  
10          includes a voice signal.

1           **37. (New)** The apparatus of claim 18 wherein:  
2           the first threshold frequency is about 2400 Hz.

1           **38. (New)** The apparatus of claim 18 further comprising:  
2           means for removing noise energy from the signal prior to the  
3           determining of the average ratio and the present ratio.

1           **39. (New)** The apparatus of claim 38 wherein:  
2           the means for removing comprise  
3           means for filtering out from the signal frequencies below a second  
4           threshold frequency lower than the first threshold frequency.



1           **40. (New)** The apparatus of claim 39 wherein:  
2           the second threshold frequency is about 100 Hz.

1           **41. (New)** The apparatus of claim 18 wherein:  
2           each of the means perform their function for each successive  
3           segment of the signal.

1           **42. (New)** The apparatus of claim 19 wherein:  
2           the means for determining an average periodicity comprise  
3           means for estimating a pitch period of the signal;  
4           means for determining a gain value of the signal over the pitch  
5           period as a function of the estimated pitch period;  
6           means for determining a periodicity of the signal over the pitch  
7           period as a function of the estimated pitch period and the gain value; and  
8           means for averaging the determined periodicity with previously-  
9           determined at least one said determined periodicity.

1           **43. (New)** The apparatus of claim 42 wherein:  
2           each of the means perform their function for each successive  
3           segment of the signal.

1           **44. (New)** The apparatus of claim 20 further comprising:  
2           means for removing noise energy from the signal prior to  
3           determining the difference between the average total energy and the  
4           present total energy.

1           **45. (New)** The apparatus of claim 18 wherein:  
2           the means for determining a difference between the average total  
3           energy and the present total energy comprise  
4           means for determining a difference between average total energy in  
5           a voiceband of the signal and present total energy in the voiceband.

- 1           **46. (New)** The apparatus of claim 45 wherein:  
2           the voiceband extends from about 100 Hz to about 400 Hz.
- 1           **47. (New)** The apparatus of claim 20 wherein:  
2           each of the means perform their function for each successive  
3   segment of the signal.